

FIRE HALL BOILER UPGRADE

280 E. Cordova St, Vancouver, BC

MECHANICAL SPECIFICATIONS ISSUED FOR TENDER

Prepared by:

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Project # 19337-V

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1 GENERAL

1.1 REFERENCES

- .1 The General Conditions of the Contract, the Supplementary Conditions, and all Sections of Division 01 apply to and are a part of this Section of the Specification.

1.2 SUBMITTALS

- .1 Prior to supplying products to the site, submit for review, 8 copies of shop drawings and/or product data sheets indicating in detail the design, construction & performance of mechanical equipment, & all mechanical products except pipe & fittings, sleeves, escutcheon plates, ductwork, & similar items. Endorse shop drawings & product data sheets with "Certified to Be In Accordance With All Requirements".
- .2 Read the following in conjunction with the wording on the Consultant's review stamp applied to shop drawings for product data sheets submitted:

"This review is for the sole purpose of ascertaining conformance with the general design concept. This review does not approve the detail design inherent in the shop drawings, responsibility for which remains with the Contractor & such review does not relieve the Contractor of the responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. Be responsible for dimensions to be confirmed & correlated at the job site, for information that pertains solely to fabrication process or to techniques of construction & installation, and for coordination of the work of all sub-trades."

- .3 Submit the following to the Consultant:
 - .1 **project close-out documentation:** O & M Manuals, record as-built drawings, and all associated data
 - .2 **progress payment breakdown:** a detailed breakdown of the mechanical work cost suitable for evaluation of progress payments
 - .3 **extended warranties:** copies of all extended warranties

1.3 DEFINITIONS

- .1 The following are definitions of words found in this mechanical work Specification and on associated drawings:
 - .1 "provide" (and tenses of provide) – means supply and install complete
 - .2 "install" (and tenses of install) – means install and connect complete
 - .3 "supply" – means supply only
 - .4 "Consultant" – means the Architect or Consulting Engineer who has prepared the Contract Documents on behalf of the Owner
 - .5 "Equal to"- means that a product proposed for installation, other than the specified product, must be equal to the specified product in size, materials of construction, performance, durability, & warranty requirements, & the final decision in this matter rests with the Consultant.

1.4 CODES, REGULATIONS, AND STANDARDS

1. All Codes, Regulations, and Standards referred to in this Section and in Sections to which this Section applies are the latest edition of the Codes, Regulations, and Standards in effect at the time of bidding on this Project.
2. All work is to be in accordance with requirements with Codes, Regulations, and Standards applied by governing authorities.
3. All mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA Standard B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.
4. Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay all associated costs associated with these submittals.
5. All electrical items associated with mechanical equipment are to be certified and bear the stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.
6. Requirements of the Contract Documents are to take precedence when they are more stringent than codes, ordinances, standards, and statutes.

1.5 EXAMINATION OF SITE

- .1 Prior to submitting a bid, visit the site & review & include for existing site conditions.

1.6 DRAWINGS AND SPECIFICATION

- .1 Mechanical drawings are performance drawings, diagrammatic, show approximate locations of equipment & services, are intended to convey scope of work, & do not show architectural and structural details. Provide offsets, fittings, transformations, & similar products required as a result of obstructions & other architectural & structural details but not shown on drawings.
- .2 The drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, all offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and structural details but not shown on the drawings.
- .3 The mechanical drawings and specification are intended to be cooperative. Perform all work that is shown, specified, or reasonably implied on the drawings but not mentioned in the specification, or vice-versa, as though fully covered by both.

1.7 PLANNING AND LAYOUT OF THE WORK

- .1 Properly plan, coordinate, & establish locations & routing of services with subcontractors such that services will clear each other as well as any obstructions.
- .2 Conceal work in partially finished or unfinished areas to the extent made possible by area construction. Install piping, to each other.

1.8 GENERAL RE: INSTALLATION OF EQUIPMENT

- .1 Unless otherwise specified install equipment in accordance with equipment manufacturers' recommendations & instructions. Governing Codes, Standards, & Regulations take precedence over manufacturer's instructions.
- .2 Ensure that proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Remove and replace any equipment which does not meet this requirement.

1.9 PERMITS, FEES, AND CERTIFICATES

- .1 Unless otherwise specified, apply for, obtain & pay for all permits required to complete the mechanical work.

1.10 WORKPLACE SAFETY

- .1 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS). Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, & maintain 1 copy at the site.
- .2 Comply with requirements of Occupational Health & Safety Regulations & all other regulations pertaining to health and safety, including worker's compensation/ insurance board & fall protection regulations.
- .3 **Asbestos, Mould, Lead Paint, Etc.:** If, during the course of work, asbestos containing materials, black mould, lead paint, or any other such materials are encountered or suspected, immediately report the discovery to the Consultant & cease all work in the area in question. Do not resume work in affected areas until the situation has been properly corrected & without written approval from the Owner.

1.11 SCAFFOLDING, RIGGING, AND HOISTING

- .1 Erect and operate scaffolding, rigging, hoisting equipment & associated hardware required for your work.

1.12 CLOSEOUT SUBMITTALS

- .1 Prior to application for Substantial Performance, submit all required items & documentation specified, including Operating & Maintenance Manuals, as-built record drawings, extended warranties, test certificates, final commissioning report, & TAB report.

1.13 EXAMINATION OF SITE

- .2 Prior to submitting a bid, visit the site & review & include for existing site conditions.

1.14 DRAWINGS AND SPECIFICATION

- .1 Mechanical drawings are performance drawings, diagrammatic, show approximate locations of equipment & services, are intended to convey scope of work, & do not show architectural and structural details. Provide offsets, fittings, transformations, & similar products required as a result of obstructions & other architectural & structural details but not shown on drawings.

1.15 PLANNING AND LAYOUT OF THE WORK

- .2 Properly plan, coordinate, & establish locations & routing of services with subcontractors such that services will clear each other as well as any obstructions.
- .3 Conceal work in partially finished or unfinished areas to the extent made possible by area construction. Install piping, to each other.

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- .1 Unless otherwise specified install equipment in accordance with equipment manufacturers' recommendations & instructions. Governing Codes, Standards, & Regulations take precedence over manufacturer's instructions.

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- .2 Unless otherwise specified, apply for, obtain & pay for all permits required to complete the mechanical work.

1.18 WORKPLACE SAFETY

- .3 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS). Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, & maintain 1 copy at the site.
- .4 Comply with requirements of Occupational Health & Safety Regulations & all other regulations pertaining to health and safety, including worker's compensation/ insurance board & fall protection regulations.
- .5 If, during the course of work, asbestos containing materials, black mould, lead paint, or any other such materials are encountered or suspected, immediately report the discovery to the Consultant & cease all work in the area in question. Do not resume work in affected areas until the situation has been properly corrected & without written approval from the Owner.

1.19 SCAFFOLDING, RIGGING, AND HOISTING

- .6 Erect and operate scaffolding, rigging, hoisting equipment & associated hardware required for your work.

1.20 CLOSEOUT SUBMITTALS

- .7 Prior to application for Substantial Performance, submit all required items & documentation specified, including Operating & Maintenance Manuals, as-built record drawings, extended warranties, test certificates, final commissioning report, & TAB report.
- .8 **Operating and Maintenance Manuals:** Submit 3 hard copies of operating & maintenance manuals in hardcover 3 "D" ring binders, & identified with Project name, & "MECHANICAL OPERATING AND MAINTENANCE MANUAL" wording. Manuals are to include an Introduction sheet listing the Consultant's, Contractor's, and Subcontractor names, street addresses, telephone & fax numbers, and e-mail addresses, a Table of Contents sheet & corresponding index tab sheets, a copy of each "Reviewed" or "Reviewed As Noted" shop drawing or product data sheet, with the email address for local source of parts & service, & all required operating & maintenance data.
- .9 **Record "As-Built" Drawings:** As work progresses, clearly mark on white prints of the Contract Drawings, significant changes from the routing of services & locations of equipment shown on the Contract Drawings. Keep the set up-to-date at all times, & available for periodic review. When work is complete, transfer as-built information from as-built drawings to a recordable and identified CAD disc with CAD work of equal quality to the Contract Drawings. CAD discs will be supplied free of charge by the Consultant.

1.21 PHASING OF THE WORK

- .1 Phasing of the work is required to maintain the existing building in operation. Include all costs for phasing including "off hours" premium time labour costs.

1.22 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

- .1 Prior to equipment & system start-up procedures, pay for equipment/system manufacturers' authorized representatives to examine the installation, & when any required corrective measures have been made, to certify in writing to the Consultant that the equipment/system installation is complete & in accordance with the equipment/system manufacturer's instructions.

1.23 EQUIPMENT AND SYSTEM START-UP

- .1 Prior to commissioning, & under supervision of equipment/system manufacturers' representatives, start-up equipment/systems, make required adjustments, document procedures, leave equipment/systems in proper operating condition, & submit start-up documentation sheets signed by the manufacturer/supplier & the Contractor

1.24 EQUIPMENT AND SYSTEM COMMISSIONING

- .1 After successful start-up and prior to Substantial Performance, commission the mechanical work in accordance with requirements of CSA Z320, Building Commissioning. Use commissioning sheets included with the CSA Standard, & any supplemental commissioning sheets required.

1.25 O & M DEMONSTRATION & TRAINING

- .1 Train the Owner's designated personnel in all aspects of operation & maintenance of equipment & systems using technicians employed by the equipment/system manufacturer/supplier. The number of hours of training are to be sufficient for the Owner's personnel to completely understand operation & maintenance of the equipment/system.

1.26 FIRESTOPPING AND SMOKE SEALS

- .1 Unless otherwise specified, where mechanical work penetrates fire rated construction, provide ULC listed & labelled firestopping & smoke seal materials installed in accordance with requirements of CAN4-S115 (ratings F, FT, FH, & FTH as required), CAN/ULC-S101, & other governing authorities to seal the penetrations.

1.27 PIPE HANGERS AND SUPPORTS

- .1 Provide pipe hangers and supports. Provide additional structural steel channels, angles, inserts, beam chaps & similar accessories required for hanging or supporting pipe. All ferrous hanger & support products are to be galvanized.
- .2 **For Insulated Pipe:** Size the hanger or support to suit the dia. of the insulated pipe & install the hanger or support on the outside of the insulation & insulation finish.
- .3 **Horizontal Above Ground Piping:** Hangers for suspended pipe to & including 25 mm (1") dia. are to be clevis type or adjustable ring type, & hangers for suspended pipe 40 mm (1½") diameter & larger are to be adjustable clevis type. Space hangers & supports in accordance with Code requirements.
- .4 **Vertical Piping:** Support vertical piping by means of steel offset pipe clamps or heavy-duty steel brackets or soil pipe brackets spaced at maximum 3 m (10') intervals or at least once for piping less than 3 m (10') in height.

- .5 **Insulation Protection Shields:** For insulated horizontal piping to & including 40 mm (1½") dia., provide galvanized steel insulation protection shields between the insulation & the hanger or support. Install shields immediately after the pipe is insulated.
- .6 **Hanger Rods:** Electro-galvanized carbon steel (unless otherwise specified), round, threaded, complete with captive machine nuts with washers at hangers, sized to suit the loading in accordance with Table 3 in MSS SP-58.

1.28 SUPPLY OF ACCESS DOORS

- .1 Supply prime coated steel access doors for mechanical work which may need maintenance or repair but which is concealed in inaccessible construction. Access doors are to be c/w mounting & finishing features to suit the construction in which they are to be installed, & sizes are to suit the concealed work. Access doors in fire rated construction are to be ULC listed and labelled and of a rating to maintain the fire separation integrity. Recessed door type access doors located in surfaces where special finishes are required are to be constructed of stainless steel with a #4 finish.

1.29 ELECTRIC MOTORS

- .1 Motors are to conform to EEMAC Standard MG1, applicable IEEE Standards, & applicable CSA C22.2 Standards, & meet NEMA standards for maximum sound level ratings under full load. The efficiency of 1 phase AC motors to 1 HP is to be in accordance with CAN/CSA C747. The efficiency of 3 phase motors 1 HP & larger is to be in accordance with CAN/CSA C390 or IEEE 112B.

1.30 ELECTRICAL POWER & CONTROL WIRING

- .1 Line and load side power wiring for mechanical work will be done as part of the electrical work.
- .2 Do all required control wiring shown and specified.

1.31 MECHANICAL WORK IDENTIFICATION

- .1 Identify all new/relocated mechanical work in accordance with existing identification standards at the site, or, if all new work or no existing site standard, identify new exposed piping & ductwork such that it can be easily seen.
- .2 **Piping:** Paint gas piping with primer & 2 coats of yellow paint in accordance with Code requirements. For electrically traced mechanical work include "ELECTRICALLY TRACED". Pipe identification is to be equal to SMS Ltd. or Brady vinyl plastic with indoor/outdoor type vinyl ink lettering & directional arrows. For pipe to and including 150 mm (6") dia., use coiled type snap-on markers. For pipe larger than 150 mm (6") dia., use saddle type strap-on markers with 2 opposite identification locations & c/w nylon cable ties. Identification wording & colours, unless otherwise indicated, is to be in accordance with CAN/CGSB-24.3.
- .3 **Exposed Piping:** Identify at every end, adjacent to valves, strainers, damper & similar accessory, at connecting equipment, on both sides of pipes & ducts penetrating floors, walls, or partitions, at 6 m (20') intervals on runs exceeding 6 m (20') in length, at least once in each room, & at least once on runs less than 6 m (20').
- .4 **Equipment:** Provide an identification nameplate for piece of equipment, including control valves, motorized dampers, instruments, & similar products. Nameplates are to be 2-ply laminated black/white plastic, minimum 12 mm x 50 mm (½" x 2") for smaller items, minimum 25 mm x 65 mm (1" x 2½") for equipment, & minimum 50 mm x 100 mm (2" x 4") for control panels & similar items. Secure nameplates with stainless steel screws unless prohibitive, in which case use epoxy cement. Equipment identification terminology is to be as per drawing identification.

- .5 **Valve Tags & Chart:** Attach a tag to each new valve, except valves located at the equipment they control. Tags are to be coloured, 40 mm (1½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match the piping identification colour, c/w a 3.2 mm (1/8") dia. by 100 mm (4") long brass plated steel bead chain, and 4 lines of engraved identification wording to indicate the valve number, size, service, & NO or NC. Prepare a computer printed chart to list tagged valves. If an existing chart is available, valve tag numbering is to be an extension of existing numbering & the new valve tag chart is to incorporate the existing chart. Frame & glaze 1 copy of the chart & affix to a wall in each main Mechanical and/or Equipment Room.

1.32 FASTENING AND SECURING HARDWARE

- .1 Provide fastening & securing hardware to maintain installations attached to the structure or to finished floors, walls & ceilings in a secure & rigid manner capable of withstanding the dead loads, live loads, superimposed dead loads, & any vibration of the installed products. Where construction is not suitable to support the loads, provide additional framing or special fasteners to ensure proper securement to the structure. Do not attach fasteners to steel deck without written consent from the Consultant.

1.33 GENERAL RE: INSTALLATION OF VALVES

- .1 Generally, valve locations are indicated or specified, however, regardless of locations shown, provide shut-off valves to isolate all systems, at the base of vertical risers, in branch take-offs at mains & risers, to isolate equipment, to permit work phasing as required, & wherever else required for proper system operation & maintenance.

1.34 PIPE LEAKAGE TESTING

- .1 Before new piping has been insulated or concealed, & before equipment, fixtures and fittings have been connected, pressure test piping for leakage in accordance with requirements of applicable Codes and Standards. Have completed test report sheets dated & signed by those present to confirm proper test results. Ensure that piping has been properly flushed, cleaned & is clear of foreign matter prior to pressure testing.

1.35 CONCRETE WORK FOR MECHANICAL EQUIPMENT BASES/PADS

- .1 Unless otherwise specified, provide all poured concrete work, including reinforcing & formwork, required for mechanical work. Concrete is to be minimum 20,700 kPa ready-mix concrete in accordance with CAN/CSA-A23.1 & the Building Code.

1.36 CUTTING, DRILLING, AND PATCHING FOR MECHANICAL WORK

- .1 Do all cutting, drilling and patching of the existing building for the installation of your work. Confirm exact locations prior to cutting and/or drilling work. Patch surfaces, where required, to exactly match existing finishes using tradesmen skilled in the particular trade or application worked on.
- .2 Where new pipes pass through existing construction, core drill an opening sized to leave 12 mm (½") clearance around pipes or pipe insulation. In poured concrete construction, determine the location, if any, of existing concealed services.
- .3 Pack and seal the void between pipe openings and the pipe or pipe insulation for the length of the opening in interior construction with rock wool & seal both ends of the opening with non-hardening silicone base caulking. Seal sleeves in exterior walls below grade (& any other wall where water leakage may be a problem) with link type mechanical seals.

1.37 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with requirements of Canadian Construction Association Standard Document CCA 81, A Best Practices Guide to Solid Waste Reduction. Do not let waste materials accumulate at the site.

1.38 DEMOLITION WORK

- .1 Where indicated on the drawings, disconnect & remove mechanical work, including existing equipment, hangers, supports, insulation, & similar items. Cut back obsolete piping behind finishes, identify, & cap water-tight. Estimate the extent & cost of the work at the site during bidding period scheduled site visit(s). Perform demolition work in accordance with requirements of CAN/CSA-S350, Code of Practice for Safety in Demolition of Structures.
- .2 If existing isolation valves are not available to isolate sections of piping to be removed, provide such valves.
- .3 Unless otherwise specified, remove & dispose of demolished materials which are not to be relocated or reused.

1.39 SEISMIC RESTRAINT ANCHOR POINTS FOR EQUIPMENT

- .1 All mechanical equipment requiring seismic restraint (see the mechanical work Section entitled Seismic Control and Restraint) is to be complete with manufacturer designed and rated seismic restraint anchor points and attachments, certified by the equipment manufacturers, so that the equipment may be bolted down or restrained in the field.
- .2 The equipment to be restrained must be designed such that the strength and anchorage of the internal components of the equipment exceeds the force level used to restrain and anchor the equipment itself to the supporting structure.

1.40 INSTALLATION OF FLEXIBLE CONNECTORS

- .1 Provide flexible connectors in piping connections to all seismically restrained equipment, and wherever else shown.
- .2 Provide flexible connectors in all piping connections to vibration isolated equipment.

1.41 TESTING, ADJUSTING & BALANCING (TAB)

- .7 Perform TAB of mechanical systems which include, as applicable, domestic hot & tempered water systems, & HVAC & control systems in accordance with either the National Standards For A Total System Balance published by the Associated Air Balance Council, or the Procedural Standards for Testing, Adjusting & Balancing of Environmental Systems published by the National Environmental Balancing Bureau. Employ an agency certified by either the Associated Air Balance Council or the National Environmental Balancing Bureau.
- .8 Submit 2 copies of draft reports on AABC or NEBB forms. One draft report will be returned. Upon approval of draft reports, submit 2 copies of final reports with schematic system diagrams & other data in identified 3-ring binders.
- .9 Spot check final report results with the Consultant, & if results do not, on a consistent basis, agree with the final report, rebalance the systems involved, resubmit the final report, & again perform spot checks with the Consultant.

1.42 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

- .1 Co-ordinate all shut-down and interruption to existing mechanical systems with the Owner. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning.
- .2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform the Owner and Consultant in writing 72 hours in advance of the proposed shut-down or interruption and obtain written approval to proceed. Do not shut-down or interrupt any system or service without such written approval.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible, and, prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.

MECHANICAL INSULATION

- .1 Provide all required mechanical work insulation. Insulation system materials inside the building must have a fire hazard rating of not more than 25 for flame spread & 50 for smoke developed when tested in accordance with CAN/ULC-S102. Thermal performance, i.e. conductivity, of insulation is to meet or exceed the values given in the National Energy Code of Canada for Buildings, & ASHRAE/IES Standard 90.1.
- .2 Submit product data sheets for insulation products.
- .3 As applicable, do not insulate heating piping within heated liquid system pump casings, valves, strainers & similar accessories.
- .4 Install insulation directly over pipes and not over hangers & supports. Install piping insulation & jacket continuous through pipe openings & sleeves. Install duct insulation continuous through walls, partitions, & similar surfaces except at fire dampers.
- .5 Where existing insulation work is damaged as a result of a new mechanical work, repair the damaged insulation work to new work standards.
- .6 **Insulation For Piping @ Hangers & Supports:** At each hanger & support location for piping 50 mm (2") dia. & larger & scheduled to be insulated, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts. Supply the insulation sections to the piping installers for installation as the pipe is erected.
- .7 **Piping Insulation-Mineral Fibre:** Unless otherwise specified, insulate the following pipe inside the building & above ground to the thickness indicated with rigid, sectional, sleeve type insulation to ASTM Standard C 547, with a factory applied vapour barrier jacket, & blanket type roll insulation to ASTM C553, 24 kg/m³ (1½ lb./ft.³) density, with a factory applied vapour barrier facing:
 - .1 hot water heating piping, supply & return, to & including 40 mm (1½") dia. - 25 mm (1") thick, & piping, larger than 40 mm (1½") dia. - 50 mm (2") thick
- .18 **Insulation Coatings, Finishes & Jackets:** Provide coatings, finishes or jackets as follows:
 - .1 **White PVC:** Roll form sheet & fitting covers equal to Johns Manville Inc. "Zeston" 300. 25/50 rated, for exposed mineral fibre pipe insulation.

- .19 **Insulation Application Requirements:** Unless otherwise specified apply insulation materials in accordance with requirements of the current edition of the BC Insulation Contractor Association Standards.

NATURAL GAS

- .2 Piping Installation: Provide natural gas distribution piping & connect gas fired or operated equipment, & provide all required vent piping to atmosphere, including vent piping from pressure regulators. Do piping work in accordance with requirements of CAN/CSA-B149.1, as amended by the TSBC & local Gas Codes. Conform to the following requirements:
- .1 slope gas piping in the direction of flow to low points, & provide full pipe dia. 150 mm (6") long drip pockets at the bottom of vertical risers, at piping low points, & wherever else shown and/or required
 - .2 ensure that supports for roof mounted piping are sized (height) to accommodate the roof slope & the required piping slope, & to permit the installation of low point dirt pockets
 - .3 Identify piping above ground with 2 coats of safety yellow enamel applied over primer, and SMS Ltd. or equal coil type vinyl identification makers with arrows
- .3 **Pressure Regulators:** Provide CSA certified pressure regulators in piping where indicated and/or required. **For indoor appliances**, use lever acting design, dead end lockup type, each c/w a vent limiter, self-aligning valve, die-cast aluminium housing, & synthetic rubber compound diaphragm, mounted in a horizontal upright position. Note that these pressure regulators do not require vent piping. Provide 6 mm (¼") diameter test ports upstream and downstream of each regulator assembly. Combine vents where permitted & increase vent pipe size accordingly. Extend vent piping up through the building 3 m (10') away from equipment air intakes & building openings and terminated in a turn-down elbow fitting with bronze bug screen. When installation is complete, check each regulator for proper operation & adjust & set each regulator to the correct discharge pressure. Indicate operating set-points, relief settings & vent arrangements for each regulating station on as-built record drawings.

HYDRONIC SYSTEMS (Project Specific)

- .1 Provide hydronic system piping & equipment. Slope horizontal piping mains to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Slope branch supply & return piping connections to equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation & maintenance of air vents. Conform to the following requirements:
- .1 refer to drawing control diagrams & details & install automatic control valves, piping wells & similar piping and/or equipment mounted control components required for automatic control systems supplied as part of the control systems work
 - .2 provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at connections to valves, strainers & similar piping system components, at equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, & wherever else indicated on the drawings
 - .3 provide circuit balancing valves in piping generally where shown but with exact locations in accordance with instructions of personnel doing system flow balancing work
 - .4 flush & chemically clean new piping after pressure testing is complete in accordance with instructions of personnel doing hydronic system water treatment work

- .5 when work is complete & equipment is operating as intended, test, adjust & balance water flows in accordance with requirements specified

END OF SECTION

1 SCOPE OF WORK

- .1 Provide new, complete, operational and tested mechanical systems for heating, controls and plumbing systems, as described herein, indicated on the drawings and in full conformance with applicable codes, standards and ordinances.
- .2 Provide all labour, materials and products as specified, as required to accomplish this work.
- .3 The scope of HVAC work for this project generally includes:
 - .1 Natural gas-fired heating boilers.
 - .2 Hydronic heating pumps
 - .3 Heating water piping and pipe insulation
 - .4 Pre-operational pipe cleaning and Chemical treatment
 - .5 Controls
 - .6 Water systems balancing
 - .7 Existing cast iron radiators thermostatic control valves
 - .8 Verification of systems operation and controls
- .4 Plumbing work will include the following:
 - .1 Natural gas piping and hook-up of the heating boilers
 - .2 Domestic water piping for the make-up water and relocation of existing piping affected by the project as required.
 - .3 Sanitary piping for the drainage.
- .5 Demolition work will include the following:
 - .1 Demolition, painting, remediation, etc, as described in the specifications and on the drawings, to accommodate the Work.
 - .2 Non-structural seismic protection
- .6 Electrical work will require the following:
 - .1 Electrical power supply to mechanical equipment
 - .2 Removal and replacement of miscellaneous electrical devices, including some new equipment

- .7 The Mechanical Contractor may act as the Prime Contractor for this project, responsible for the coordination of all trades required to carry out the work described herein.

2 CASH ALLOWANCES

- .1 Cash Allowance No. 1 For AutoCad drafting of Record Drawings, INCLUDE in the submitted tender a Cash Allowance amount of \$1,500.00.
- .1 The Cash Allowance amounts stated do NOT include Contractor's overhead and profit. The Cash Allowance pertain strictly to the work provided specific to Cash Allowance (i.e. commissioning, structural work, etc.) The Contractor's overhead and profit for work pertaining to the Cash Allowances are to be included in the Contractor's base tender.
- .2 The Cash Allowance amounts stated do NOT include Value added Taxes (GST).

END OF SECTION

1 PRODUCTS – CONDITIONS FOR ACCEPTANCE

- .1 Base Bid means an item is specified by manufacturer and model number meets the specifications in all respects regarding performance, quality of material and workmanship and is acceptable to the Consultant without qualification. Base Bid equipment is as listed in the Specification and Mechanical Equipment Schedules and on the Drawings.
- .2 Approved Equal means the Consultant has deemed the manufacturer capable of producing material, fixture or equipment of comparable quality. Products supplied by an approved equal must match the specified product in performance, approximate dimensions, quality of material and quality of workmanship. If in the opinion of the Consultant material submitted for review does not meet these criteria, satisfactory material from the equal manufacturer shall be provided, or the Contractor will revert to the Base Bid product.
- .3 Alternate means the Consultant may deem a manufacturer capable of producing substitute material, fixture, or equipment which will fulfill project requirements but may differ in material, quality, performance, characteristics, methods of construction or mode of operation. Alternate equipment suggested by bidders will be indicated as a separate item, with applicable cost differences from the specified product(s). The bidder's tender will include a product supplied by a manufacturer indicated in the approved equals list as a part of the bidder's base tender price.
- .4 The use of an equal or alternate product shall in no way relieve Division 15 from the responsibility of furnishing all work that may be required by reason of different space, weight or electrical requirements from that of the specified manufacturer. If, in the opinion of the Consultant, such work is necessary and is not carried out in a manner, which will ensure satisfactory operation and performance of the equipment, then the specified manufacturer shall be used.
- .5 Requests for review from manufacturers of materials, fixtures and equipment who are not listed as equal and wish to be accorded "equal" status, shall be made at least seven (7) days prior to close of tender. Such material, fixtures, and equipment shall meet the requirements for an equal as described in the Standard of Acceptance. All information required by the Consultant to evaluate proposed manufacturer shall furnish the proposal at the time of the request.
- .6 Mechanical systems have been designed based on equipment from the Base Bid manufacturer. The onus shall be on the Mechanical Contractor in conjunction with the equal or alternate supplier(s) to ensure that their equipment will meet the required performance characteristics, electrical characteristics, as well as fit properly into allotted space including allowing for the required access and service spaces. Any additional costs incurred as a result of modifications to the system or room layout, or modifications required by other trades shall be borne by the Mechanical Contractor.
- .7 Provide within 24 hours a list of equipment and manufacturers to be used on this project. This list shall not be deviated from unless delivery, performance, or dimension issues require a change to be reviewed by the Consultant.
- .8 If shop drawings of any product submitted are rejected on technical reasons after three submissions, the Contractor at no additional expense to the Owner shall revert the

specified product and manufacturer for this project.

2 PRODUCTS – BASE BID AND APPROVED EQUAL MANUFACTURERS

Automatic Air Vent	Hoffman, Braukman, Sarco, Armstrong, Maid-O-Mist
Balancing Agency	MDT Systems, Scott Technical, Flotech, Honey's Technical, Western Mechanical, KD Engineering, BC Tech Engineering. Stasis, Airmec
Commissioning Agency	MDT, KD Engineering, WESTERN Mechanical
Chemical Water Treatment	State Chemical Ltd.
Expansion Tanks	Amtrol,
Firestopping and Smoke Seals	3M, Tremco, Hilti
Flow and Pressure Switches	Potter, System Sensor
Gas Pressure Regulating Valves	Fisher, Rockwell, Pietro Fiorentini
Identification – Pipe	3M, SMS, Duramark, Bradley
Insulation – Piping	3M, Dow, Fibrex, Knauf, Johns-Manville, Owens Corning, Pittsburgh Corning, Manson, Roxul, Fibreglass Canada, Certainteed
Insulation Jacketing	Childers, Fiberglas, Johns-Manville
Low Water Cutoffs	McDonnell Miller (Float type with manual reset)
Pipe Couplings - Di-Electric	Watts, AG Specialties
Pipe Couplings - Flexible	Mason, Flexonics, Hyspan, Goodall, Victaulic, Proco
Pipe Fittings and Flanges	Crane, Grinnell, Jenkins
Pipe Supports and Hangers	Crane, Unistrut, Myatt, Grinnell, Sarco,

	Hunt, Taylor
Pressure Gauges	Weiss, Ashcroft, Terice, Marsh, Winter, Miljoco
Pressure Reducing Valves	Watts, Singer
Pressure Relief Valves	Watts, Singer, Braukmann, Conbraco, Sarco
Strainers	Red & White, Sarco, Armstrong, Mueller, Watts, Conbraco
Thermometers	Weiss, Ashcroft, Terice, Marsh, Winter, Miljoco
Valves (Ball, Gate, Globe, Check)	Red & White/Toyo, Grinnell, Watts, Kitz, Crane, Milwaukee, Conbraco
Valves (Circuit Balancing)	Tour & Anderson, Bell & Gossett, Armstrong, Griswald, Hattersley
Vibration Isolation	Mason, Vibron, VMC-Korfund, Mason, LoRez

3 TEMPORARY USE OF EQUIPMENT

- .1 Permanent systems and equipment are not to be used during construction period without prior written consent from the Owner.
- .2 Heating systems may be used for temporary heating within the limitations specified below.
- .3 Equipment used during the construction period is to be thoroughly cleaned and overhauled. Replace worn or damaged parts so equipment is in perfect condition, to the satisfaction of the Owner and the Consultant.
- .4 Provide proper care, attention and maintenance for equipment while in temporary operation. If in the opinion of the Consultant sufficient care and maintenance is not being given to equipment and systems, the Consultant reserves right to forbid further use.
- .5 Temporary use of systems and equipment shall in no way affect the guarantee-warranty period on all mechanical systems installed, which comes into effect from the date of Substantial Performance.
- .6 Replace all filters in air systems and seals in pumps used during temporary operation just prior to turnover to the Owner.

4 ELECTRIC WIRING AND MOTORS

- .1 All electrical equipment supplied by the Mechanical contractor shall bear CSA label. Obtain special inspection labels required by Provincial Authority having jurisdiction for equipment that does not have a CSA label and/or a ULC label.
- .2 All electrical equipment and wiring shall conform to requirements of Canadian Electrical Code, the Provincial Electrical Inspector and specified standards.
- .3 All electrical motors shall conform to CEMA and CSA standards for hard, continuous service, designed to limit temperature rise to 40 deg C for open housing and 50 deg C for drip proof housing, and operate 1200 or 1800 RPM unless otherwise specified. Do not use air over ratings.
- .4 Motors shall have ball or roller type bearings with grease lubrication fittings.
- .5 All belt-driven motors shall be mounted on adjustable bases with adjusting screws so that proper belt tension can be obtained.
- .6 Motors of 15 KW and greater shall have capacitor and thermistor over heat protection.
- .7 Motor noise criteria shall not exceed NC-60.
- .8 Motors shall meet or exceed BC Hydro Power Smart High Efficiency standards.
- .9 All motors shall meet or exceed requirement necessary for variable frequency drive applications when this technology is used.
- .10 It shall be the responsibility of Division 15 to supply high efficiency motors with proper voltage characteristics to suit electrical distribution systems and suitable construction such as explosion-proof, dust-proof, part wind starting, etc., as required to suit operating conditions. Division 15 is responsible of complete working installation and must coordinate all electrical and control work.
- .11 Division 16 will provide and install all power wiring and connection of such to motor driven mechanical equipment.
- .12 Division 16 will provide and install motor starters for electric motors except where equipment is furnished with integral starters.
- .13 Division 15 shall provide and install all control wiring required to operate the mechanical systems, whether line or low voltage.

5 IDENTIFICATION

5.1 Piping

- .1 Identify fluids in piping with markers showing name, pipe size and service, including temperature and pressure where relevant, and with arrows to indicate flow direction.
- .2 Use CGSB 23-GP-3a and CSA B53 color codings and identification systems, using

CGSB 1-GP-12c Color Coding System Schedule.

- .3 Standard of Acceptance: WH Brady identification tapes, bands, and markers.
- .4 For retrofit projects match existing identification system present in building.

5.2 Valves and Controllers

- .1 Provide aluminum or lamacoid tags with stamped code lettering and numbers filled with black paint and secured to items.
- .2 Provide for all operable valves on all piping systems.
- .3 Provide a valve list showing the tag number, the location of the valve and its use, for inclusion in the Operation and Maintenance Manuals.

5.3 Equipment

- .1 Provide factory supplied and installed nameplate on each piece of equipment.
- .2 Provide registration/approval nameplates (ie. CSA, ULC, ASME) in accordance with the requirements of authorities having jurisdiction.

6 START UP OF MECHANICAL SYSTEMS AND EQUIPMENT

- .1 Give the Consultant 72 hours written notice of date of start-up or commissioning of equipment or systems.
- .2 From the time of equipment or systems commissioning there shall be a three-week stabilization period during which the Contractor shall ensure that all systems are functioning as intended. After the three-week stabilization period, provide written confirmation that systems are fully compliant with requirements of the contract documents. This will be a requirement of Substantial Performance of the work.

7 REDUNDANT EQUIPMENT

- .1 The Owner does not wish to retain any of the existing mechanical equipment, ductwork or piping removed from these buildings during the demolition work.
- .2 Remove these materials from the site and dispose of in a manner conforming to Worksafe BC (WCB) and environmental codes and standards

END OF SECTION

1 IN-LINE HEATING PUMPS

- .1 Primary boiler pumps P-B1 to P-B2 and secondary pump P-1 shall be supplied as specified.
- .2 Pumps of cast iron housing with drip proof, resiliently mounted, statically and dynamically balance rotating parts and can handle large temperature range due to air cooled electronics.
- .3 Pump construction shall permit complete servicing without breaking piping or motor connections.
- .4 Pumps to be AUTOADAPT, FLOWADAPT, and FLOWLIMIT with automatic night set back and heat recovery monitor. No external motor protection required. Pumps to include built-in differential-pressure and temperature sensor, control box and control panel with TFT display on the control box.
- .5 The pump to be canned-rotor type which pump and motor form an integral unit without shaft seal and with only two gaskets for sealing. The bearings to be lubricated by the pumped liquid.
- .6 Pump connections shall be flanged.
- .7 Each pump shall be supplied with a shut-off valve on both inlet and outlet, a strainer on the suction side and a check valve and balancing valve on the discharge side.
- .8 Pumps must be installed to provide free, clear, and unencumbered maintenance access.
- .9 Performance as indicated in the Mechanical Equipment Schedules. Pump to include all-encompassing range and built-in communication capabilities.
- .10 The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region
- .11 The following control modes are to be available:
 - .1 Proportional Pressure control - The pump head is changed continuously in accordance with the water demand in the system.
 - .2 Constant Pressure control - A constant head is maintained, irrespective of water demand.
 - .3 AUTOADAPT - The differential pressure across the pump is automatically adjusted to match the flow requirements
- .12 Control panels on terminal boxes should enable selection of the any of the above control modes without any external devices. The control panel should also enable setting desired Pressure set-point. The control panel should show an estimation of flow rate through the pump in 0-100% range.
- .13 Approved Manufacturers: Grundfos, Armstrong, ITT B&G, TACO

3 EXPANSION TANK

- .1 Vertical expansion tank with base, constructed of welded steel to the requirements of ASME Section VIII, Division 1. Factory prime coat painted and with heavy-duty butyl diaphragm. (replaceable butyl bladder). Rated for a working pressure of 861 kPa (125 PSIG) and operating temperature up to 115 deg C (240 deg F).
- .2 Supply with steel support saddle for vertical mounting, lifting ring, charging valve, 13-mm (1/2-inch) system connection and 38-mm (1-1/2-inch) charging tap.
- .3 Provide seismic restraint ring, factory welded to the tank.
- .4 Selection: (Replaceable bladder type) Amtrol Extrol model **AX-20V**, 41.5 litres volume 9.5 acceptance volume.

4 LOW LOSS HEADER

- .1 Primary/secondary low-loss header complete with insulation. The header shall be designed for maximum operating pressure of 150 PSI at a maximum operating temperature of 220°F. The header shall function as a combination air separator and manifold that creates independent primary and secondary circuits. The header body shall be made of steel and equipped with brass air vent and drain valve.
- .2 The primary/secondary header shall be manufactured ITT Bell & Gossett or Caleffi.
- .3 Piping connections shall be 150Ø (6"), flow on both sides 247 gpm.
- .4 Automatic air vent at top of unit and blowdown valve at the bottom to allow manual removal of impurities. Separator shall have internal screen designed to promote air elimination at top of chamber.
- .5 Provide 2", rigid closed cell expanded polyurethane foam insulating jacket with embossed foam jacket.

5 SIDESTREAM FILTER

- .1 All closed heating water systems shall have a sidestream filter supplied by the Chemical Treatment specialist and installed by the Contractor as indicated on the drawings.
- .2 Housing of steel construction using 250 mm x 30 micron filter cartridge, with a minimum flow rate of 0.6 L/s (9 USGPM). A Flow Indicator shall be installed in conjunction with the sidestream filter.
- .3 Connections shall be 20 mm and all isolating valves shall be installed as per manufacturer's instructions. Include filter cartridges.
- .4 Refer also to pipe cleaning and chemical treatment Section for more info.

END OF SECTION

1 CONTRACTUAL RELATIONSHIP

- .1 The Chemical Treatment Specialist will be retained and paid by the Mechanical Contractor but must be the agency the Owner typically deals with.
- .2 The Contractor is to obtain and include a price for Chemical Treatment work provided by State Chemical Ltd.

2 SCOPE OF CHEMICAL TREATMENT WORK

2.1 Quality Assurance

- .1 At completion of the heating water installation thoroughly flush the system and retain a water treatment specialist to chemically treat the system. The chemical treatment sub-trade will supply for installation by the mechanical contractor a chemical pot-feeder and all chemicals and coupons required for the operation of the system until the expiry of the one-year warranty from the time of Substantial Completion.
- .2 During the one-year warranty period, at 6 months and 12 months from the date of Substantial Completion, the chemical treatment sub-trade will monitor the levels of chemical treatment in the heating system and add chemicals as required to maintain the required levels of treatment necessary for control of nitrates and chromates and to provide adequate corrosion protection.
- .3 The water treatment chemicals and treatment process shall be supplied and performed by the Contractor. This work shall be supervised by the Water Treatment Specialist who, upon completion shall certify that the process is satisfactory and submit a report outlining the cleaning operation and the treatment process for inclusion in the Operations and Maintenance manual.
- .4 Notify Consultant 72 hours prior to chemical cleaning so that work may be verified and inspected.

2.2 Submittals

- .1 Submit shop drawings including proposed chemicals, quantities, calculations, procedures and equipment to be supplied. Provide written operating instructions and system schematics.
- .2 Provide written report containing log and procedure of system cleaning, giving times, dates, problems encountered and condition of water.

3 EXECUTION

3.1 Pre-Operational Cleaning and Chemical Treatment

- .1 All systems (existing and new) must be chemically cleaned and flushed before water treatment is added. This includes partial or complete filling for pressure testing.

- .2 Provide drain connections to drain system in one hour.
- .3 All drains for chemical treatment shall be piped to the sanitary sewer.
- .4 Install totalizing water meter(s) and record capacity in each system.
- .5 After all components of the piping system have been pressure tested and proven to be in full operational condition and leak free, flush entire system with fresh, clean make-up water to remove loose mill scale, sediment and construction debris.
- .6 After initial flushing has been completed, clean all strainer screens. **DO NOT FLUSH SYSTEMS THROUGH THE BOILERS.**
- .7 System pumps may be used for cleaning, provided that pumps are dismantled and inspected, worn parts repaired with new gaskets and seals installed. Submit used seals. **Confirm with pump manufacturer prior to use of pumps.**
- .8 Add cleaner to closed systems at concentration levels recommended by the Water Treatment Specialist.
- .9 For hot water heating systems, apply heat while circulating, raise temperature slowly to 70°C and maintain at 70°C for minimum of 12 hours. Remove heat and circulate at 40°C or less. After cleaning, drain system as rapidly as possible. Flush system by opening drain valves and opening bypass valve on water make-up to system. Continue flushing until test show pH, Iron, TDS and Chloride levels of water leaving system are the same as entering system. Install corrosion coupons, refill system and immediately add water treatment to proper level.
- .10 **The entire heating water system (existing and new) must be flushed and chemically treated as specified. Flushing of entire system must be performed until test results adhere to specifications.**
- .11 Use neutralizing agents upon recommendation of the Water Treatment Specialist and as approved by Consultant.
- .12 Inspect, remove sludge and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.
- .13 Flush open systems with clean water for minimum of one hour. Drain completely and refill. Continue flushing until test show pH, Iron, TDS and Chloride levels of water leaving system are the same as entering system. Stop flushing. Immediately add corrosion inhibitor and test to ensure proper level.

2.2 Cleaning and Chlorination of Potable Water Piping (Project Specific)

- .1 All domestic water piping shall be thoroughly flushed so that it is free from scale, sediment, construction debris etc.
- .2 Retain an independent inspection firm to supervise and inspect the chlorination and flushing procedures and perform chemical tests as required.

- .3 On completion of installation and testing of the potable water systems, pre-flush, chlorinate with Sodium Hypochlorite to AWWA C-601 specifications and let stand for 24 hours. Thoroughly flush again until flush water meets AWWA standards.
- .4 Remove two samples of water 24 hours after chlorinating and provide test lab results of samples.
- .5 Both sample tests must indicate less than 10 PPM residual chlorine and less than 1 PPM total coliform. If not, repeat the chlorination and testing procedure until satisfactory results are obtained.
- .6 Include documentation from the testing laboratory in the Operation and Maintenance Manual, indicating water test results obtained.
- .7 Acceptable Firms: PACE Chemicals Ltd., GE Betz Dearborn.

3 PRODUCTS

3.1 Materials

- .1 System Cleaner: Use a Sodium Metasilicate, Sodium Nitrite and a wetting agent compound which in solution removes grease and petroleum products. Concentration level to be determined by Water Treatment Specialist. (PACE Chemicals Ltd. – PURGEX L-24 or approved equal)
- .2 Closed System Treatment (Hot Water): Use all-organic based corrosion inhibitor. Maintain levels at 60 to 100 ppm. (PACE Chemicals Ltd. – BAR COR CWS-105 or approved equal.) *Note: The use of Nitrite only, Molybdate only or Sulphite only will not be accepted.*
- .3 Provide sufficient chemicals to treat the system from the time of commissioning to acceptance of the building. In addition, provide a stock of chemicals, filters and corrosion coupons suitable for twelve (12) months normal operation.
- .4 Materials which may contact finished areas must be colourless.

3.2 Equipment

- .1 Closed System Heating Water Loops
 - .1 Bypass Pot Feeder: shell and head to be constructed of 11-gauge steel. Cap to be constructed of cast iron with Buna N seal ring. Corrosion coupon holder to be stainless steel. 20-mm (3/4-inch) screwed inlet and outlet connections. Tank

capacity 7.6 litres (2 US gallons) suitable for 1380 kPa (200 psig) working pressure), with quick opening cap and complete with 20-mm (3/4-inch) connections. Provide isolating valves on the inlet, outlet and drain lines.

- .2 Sidestream Filter: All closed hot water and chilled water systems shall have a sidestream filter housing of steel construction using 250 mm x 30 micron filter cartridge, with a minimum flow rate of 0.6 L/s per minute (9 USGPM). A Flow Indicator shall be installed in conjunction with the sidestream filter. Connections shall be 20 mm MxFNPT and all isolating valves shall be installed as per manufacturer's instructions. Include filter cartridges.
- .3 Totalizing Make-up Water Meter: Cast Bronze body, 20 mm NPT connections, thermoplastic rotor and gear train, rated at 1034 kPa [150 psi] maximum operating pressure, with DDC interface.
- .4 Chemical Feed Piping: Schedule 40 black steel
- .5 Corrosion Coupon and Holder Assembly:
 - .1 Mild steel corrosion coupon.
 - .2 Holder, 20 mm or 25 mm NPT male connection.
 - .3 Provide malleable or cast-iron cross, 20 mm or 25 mm NPT female connection.
- .2 Refer to drawings for piping assembly and hook-up.

4 TEST KITS

- .1 Provide test kits to determine proper systems treatment, including but not limited to the following:

4.1 Closed System Test Kit

- .1 To determine proper level of inhibitor in closed system treatment.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for boilers, including accessories, and all required wiring schematics. Include boiler flue product data sheets with the submission.
- .2 **Factory Inspection and Test Report:** Submit with delivery of the boiler(s) a copy of the factory inspection and test report for each boiler, and include a copy of each report with O & M Manual project close-out data.
- .3 **Site Inspection and Start-Up Report:** Submit a site inspection and boiler start-up report from the boiler manufacturer's representative as specified in Part 3 of this Section.
- .4 **Heat Exchanger Warranty:** Submit a signed copy of the manufacturer's extended ten year warranty on the heat exchanger.

1.2 Quality Assurance

- .1 **Codes and Regulations:** Boilers and installation of boilers are to be in accordance with requirements of the following:
 - .1 All applicable Provincial Codes and Standards
 - .2 CSA-B51, Boiler, Pressure Vessel and Pressure Piping Code
 - .3 CAN/CSA-B149.1, Natural Gas and Propane Installation Codes
 - .4 CAN1-3.1, Industrial and Commercial Gas-Fired Package Boilers
- .2 **Installation Tradesmen:** Boiler installation tradesmen are to be journeyman tradesmen licensed to install boiler equipment.

2 PRODUCTS

2.1 Finned Tube Hot Water Boilers

- .1 Raypak Inc. "Raytherm®" Type H Series, 115 volt, 1 phase, 60 Hz, atmospheric, package type, natural gas fired, two pass, finned tube hot water boilers as per the drawing schedule, each factory inspected and tested prior to shipment, and sized to fit through a standard doorway.
- .2 **Performance Features:** Boilers are to be rated for a 1100 kPa (160 psi) working pressure and a maximum 110° C (230° F) operating temperature, and are to have a CSA certified minimum thermal efficiency at full fire of 80%. The boiler shall be capable of operating at inlet water temperatures as low as 105° F without condensation.
- .3 **Heat Exchanger:** The heat exchanger is to be of a single-bank, horizontal-grid design integral copper fin tubes, each end of which is lotted into an ASME boiler-quality steel tube sheet. The header shall be secured to the tube sheet by stud bolts with flange nuts to permit inspection and maintenance without removal of external piping connections. The heat exchanger shall incorporate "V" baffles, between the tubes, to ensure complete contact of the external tube surfaces with the product of combustion. The heat exchanger shall be AB-1953 complaint in construction and verification by a third-party certification agency.
- .4 **Boiler Enclosure:** Removable galvanized steel jacket assembly on a raised steel base, finished with baked-on powder epoxy enamel applied prior to assembly, and equipped with a draft hood.
- .5 **Seismic Restraint Anchor Points:** Factory installed and certified seismic restraint anchor points

- .6 **Boiler Trim:** Each boiler is to be equipped with the following trim:
 - .1 A probe type manual reset low water cut-off control wired to the burner control circuit to prevent burner operation if the boiler water fall below a safe level, an auxiliary low water cut-off, and a mcdonnell & Miller Model TC-4 "Test-N-Check" valve above and below both low water cut-offs
 - .2 A flow switch supplied loose for site installation and wiring to the burner control circuit to prevent burner operation when a no-flow condition occurs
 - .3 A combination temperature/pressure gauge
 - .4 A minimum of three controls for regulation of burner operation, mounted on the boiler with sensing element located adjacent to the boiler outlet, one auto reset type for burner on-off control, one for burner firing rate, and one manual reset type for burner cut-out due to excessive water temperature
 - .5 ASME rated relief valves
- .7 **Burner:** Stainless steel atmospheric burner for firing rates between 20% and 100%, and mounted in a slide-out drawer to permit removal for inspection. Burners are to be factory fire tested and designed to return to the low fire position prior to ignition and to remain in the low fire position during ignition and until main flame has been proven, and constructed to burn the specified quantity of fuel without objectionable noise, pulsation, or vibration. Each burner is to be complete with:
 - .1 A high/low fire 2-stage gas valve
 - .2 Intermittent electronic spark pilot ignition with igniter located away from the water inlet to protect from condensation, and pilot flame supervision with 100% safety shut-down and an ignition control module
 - .3 A factory piped and wired main gas piping train with primary motorized gas shut-off valve controlled to start or stop the burner and to close automatically in the event of power failure, flame failure, excessive pressure or temperature, high or low gas pressure, low water or flow condition, a manual shut-off valve located ahead of the primary valve, a plugged leakage test connection with shut-off cock as a means of testing the tightness of the primary valve, and a gas pressure regulator
 - .4 A factory piped and wired pilot gas piping train with separate pilot gas cock, gas pressure regulator, and pilot safety shut-off gas valve
- .8 **Boiler and Burner Controls:** Boiler and burner controls, unless otherwise specified, are to factory installed in a boiler mounted enclosure equipped with power and control wiring terminal blocks, control circuit transformer, and the following:
 - .1 Digital water and air temperature sensors/controllers supplied loose for site installation
 - .2 An automatic reset an a manual reset type high temperature limit switch
 - .3 An on-off switch with indicator light
 - .4 Additional safety controls consisting of low water shut-down, no-flow shut-down, manual reset high and low gas pressure switches
 - .5 Contacts for connection to the Boiler Room ventilation system to prevent the boilers from operating unless the ventilation system is operating (the ventilation system is to "fail-open" to permit boiler operation should the fan or damper motors fail or a power failure occurs)
 - .6 An adjustable time delay switch to be field wired such that when the circulating pump is shut-down the boiler will shut-down first and the pump will continue to operate for approximately thirty seconds (adjustable) to allow boiler heat to dissipate, then the pump will shut-down
- .9 **Building Automation System Interface:** Boiler controls are to include all hardware necessary for interface of boiler controls with the building automation system as per drawing control diagrams/sequences and points lists, or third party controls.

- .10 **Acceptable Manufacturers:** Acceptable manufacturers are:
- .1 Raypak- Type H
 - .2 Allied Engineering Co. "Super Hot"
 - .3 Laars Heating Systems Co.
 - .4 Lochinvar Corp.
 - .5 Patterson-Kelly

2.2 Boiler Plant Sequencing Control Panel

- .1 Surface wall mounting, EEMAC 2, dead front, enamelled steel, 115 volt, 1 phase, 60 Hz AC, electronic, microprocessor based, CSA certified, fully automatic boiler plant master sequencing control panel supplied by the boiler manufacturer for lead-lag control of boiler operation with simple on-off switching of individual boilers, and boiler water temperature control as indicated.
- .2 **Panel Components:** The panel is to be complete with:
- .1 A key lock door, and a door interlock type disconnect switch
 - .2 A green "POWER ON" LED and a white "BOILER OPERATING" LED for each boiler
 - .3 A door mounted two-position "MANUAL/AUTOMATIC" switch for each boiler, connected such that when a switch is in the "MANUAL" position the respective boiler is disconnected from the automatic sequence and will operate independently through its own controls while the remaining boilers operate automatically through the sequencing controls
 - .4 A rotary type, door mounted lead boiler selector switch, connected such that regardless of which boiler is chosen as the lead boiler the remaining boilers will operate in the required sequence in numerical order, and with circuits isolated in the programmer circuit such that the switch may be rotated at any time with any number of boilers operating without overloading its contacts, and such that the boilers remaining on line will not recycle thereby permitting changing of the lead boiler without material loss of load
 - .5 A fused 24 volt secondary control transformer
 - .6 Numbered terminal strips for power and control wiring connections
 - .7 All hardware and circuitry required for the specified control and sequencing, including an adjustable time delay which is to be activated before the lead boiler reaches high fire to allow the lead boiler sufficient time to satisfy system demand before the first lag boiler is activated
 - .8 Permanent identification of all door mounted LED's and switches
 - .9 Operating control components as required, supplied loose for site installation
- .3 **Control Sequence:** The boiler plant control sequence is to be as follows:
- .1 On the first call for heat the lead boiler will come on line at low fire, and if system demand is such that the output of the lead boiler will not satisfy demand at low fire the boiler will modulate to high fire
 - .2 If the lead boiler is unable to satisfy system demand by the time it reaches 80% of its firing rate, and over a reasonable period of time, the first lag boiler is to come on line at low fire and, if required, modulate to high fire
 - .3 Remaining lag boiler(s) are to be brought on line as above as required to satisfy system demand
 - .4 As system demand is satisfied, the boilers are to modulate back to low fire and shut-off in reverse order
- .4 **BAS/ Third party Connection Hardware:** The panel is to be suitable in all respects for interface connection into the building automation system without site installation of additional hardware.

3 EXECUTION

3.1 Installation of Boilers

- .1 Provide hot water boilers where shown.
- .2 Secure each boiler in place, level and plumb, on neoprene-steel-neoprene vibration isolation pads on a concrete housekeeping pad.
- .3 Anchor each boiler and concrete base in accordance with requirements specified in the mechanical work Section entitled Seismic Restraint and Control. Provide flexible connections in **all** piping connections to each boiler.
- .4 Connect each boiler with a flue as indicated, and equip each boiler with a hose end drain valve.
- .5 Install all control and safety components shipped loose. Unless otherwise instructed, follow the manufacturer's installation instructions.
- .6 Wall mount the control panel where shown but confirm exact location prior to installation.
- .7 Do all required operational and safety component control wiring in conduit to connect to components. Follow the boiler manufacturer's control wiring schematics and conduit and conductor installation requirements specified as part of the electrical work.
- .8 When the boiler plant installation is substantially complete, but prior to start-up, and prior to flushing and cleaning the heating piping system as specified in the mechanical work Section entitled HVAC Water Treatment, inspect each boiler and remove all visible dirt, oil and debris, then cooperate with the boiler boil-out chemical supplier to ensure proper boil-out procedures are followed.
- .9 **Equipment and System Manufacturer's Certification:** Refer to the article entitled Equipment and System Manufacturer's Certification in the mechanical work Section entitled Mechanical General Requirements.
- .10 **Start-Up:** Refer to the article entitled Equipment and System Start-up in the mechanical work Section entitled Mechanical General Requirements.
- .11 **Commissioning:** Refer to commissioning requirements specified in the mechanical work Section entitled Mechanical General Requirements.
- .12 **Demonstration and Training:** Refer to the article entitled Equipment and System O&M Demonstration & Training in the mechanical work Section entitled Mechanical General Requirements. Include for 8 hours of on-site boiler plant operation demonstration and training for 2 groups of 6 people. The training is to be a full review of all components including but not limited to a full boiler internal inspection, construction details, burner operation, maintenance, flame characteristics, and adjustments, gas train maintenance, boiler normal operation, abnormal events, normal shut-down, emergency shut-down, and setting up controls.

END OF SECTION